The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

THREE-YEAR SEQUENCE FOR HIGH SCHOOL MATHEMATICS

COURSE II

Tuesday, January 22, 2002 — 1:15 to 4:15 p.m., only

Notice . . .

Scientific calculators must be available to all students taking this examination.

The last page of the booklet is the answer sheet. Fold the last page along the perforations and, slowly and carefully, tear off the answer sheet. Then fill in the heading of the answer sheet.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. The answer sheet cannot be accepted if you fail to sign this declaration.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part I

Answer 30 questions from this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Write your answers in the spaces provided on the separate answer sheet. Where applicable, answers may be left in terms of ≠ or in radical form. [60]

1 In $\triangle ABC$, D is a point on $\overline{AB}$ and E is a point on $\overline{AC}$ such that $\overline{DE} \parallel \overline{BC}$. If $AB = 12$, $AC = 18$, and $AD = 4$, find the length of $\overline{AE}$.

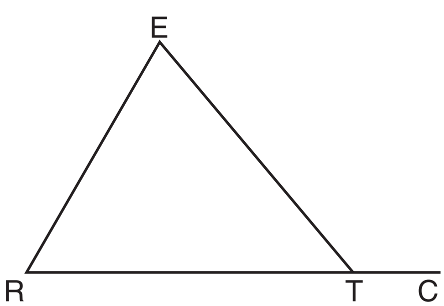
2 The operation ☺ for the set $\{S,M,I,L,E\}$ is defined in the accompanying table. If S ☺ $M = x$ ☺ E, solve for x.

☺	*S*	*M*	*I*	*L*	*E*
S	*S*	*M*	*I*	*L*	*E*
M	*E*	*S*	*M*	*I*	*L*
I	*L*	*E*	*S*	*M*	*I*
L	*I*	*L*	*E*	*S*	*M*
E	*M*	*I*	*L*	*E*	*S*

3 What is the area of the triangle whose vertices are (3,1), (7,1), and (6,4)?

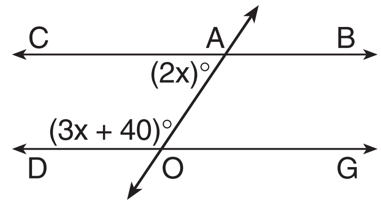
4 In $\triangle ABC$, $m\angle B$ is 4 more than twice $m\angle A$, and $m\angle C$ is 12 more than $m\angle B$. What is the longest side of $\triangle ABC$?

5 In the accompanying diagram of $\triangle RET$, side $\overline{RT}$ is extended through T to C. If $m\angle ETC = 6x + 10$, $m\angle RET = x + 50$, and $m\angle ERT = 4x - 20$, find the value of x.



6 Find the distance between the two points whose coordinates are $(-5,-4)$ and $(3,2)$.

7 In the accompanying diagram, $\overleftrightarrow{CAB}$ is parallel to $\overleftrightarrow{DOG}$, $\overleftrightarrow{AO}$ is a transversal, $m\angle CAO = 2x$, and $m\angle DOA = 3x + 40$. Find $m\angle CAO$.



8 What is the total number of different five-person committees that can be formed from a group of eight people?

9 What is the total number of different eight-letter arrangements that can be formed from the letters in the word "TOMATOES"?

10 The lengths of the bases of an isosceles trapezoid are 20 and 44, and the length of the altitude is 16. Find the length of a leg of the trapezoid.

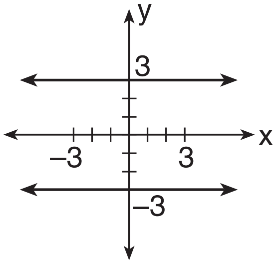
11 Find the image of point $P(-6,5)$ under a reflection in the origin.

Directions (12–35): For *each* question chosen, write on the separate answer sheet the *numeral* preceding the word or expression that best completes the statement or answers the question.

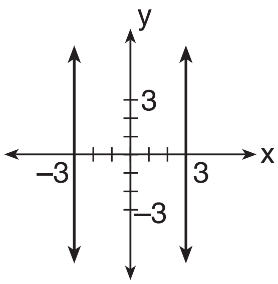
12 If ❤ is a binary operation defined by a ❤ $b = a^b + b^a$, the value of 2 ❤ 3 is

(1) 12
(2) 15
(3) 17
(4) 125

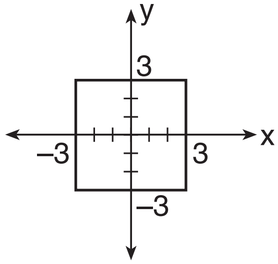
13 Which graph represents the locus of points 3 units from the origin?



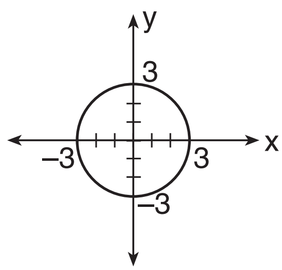
(1)



(2)



(3)



(4)

14 The coordinates of the vertices of right triangle SUE are $S(6,0)$, $U(0,8)$, and $E(0,0)$. What are the coordinates of the midpoint of the hypotenuse?

(1) (3,4)
(2) (3,0)
(3) (0,4)
(4) $(2, \frac{8}{3})$

15 If $(x - 3)^2 = 5$, then x is equal to

(1) $3 \pm \sqrt{5}$
(2) $-3 \pm \sqrt{5}$
(3) $-\sqrt{5} \pm 3$
(4) $\frac{\pm\sqrt{5}}{3}$

16 When two parallel lines are cut by a transversal, which angles are *not* always congruent?

(1) a pair of alternate interior angles
(2) a pair of alternate exterior angles
(3) two interior angles on the same side of the transversal
(4) two corresponding angles

17 A triangle that has vertices (1,1), (–4,1), and (3,3) is

(1) a right triangle
(2) an isosceles but not an equilateral triangle
(3) an equilateral triangle
(4) a scalene triangle

18 What is the negation of the statement "Suzanne likes to rollerblade and Bryan likes to work out at the gym"?

(1) Suzanne likes to rollerblade and Bryan does not like to work out at the gym.
(2) Suzanne does not like to rollerblade or Bryan does not like to work out at the gym.
(3) Suzanne does not like to rollerblade and Bryan does not like to work out at the gym.
(4) Bryan likes to rollerblade and Suzanne likes to work out at the gym.

19 In right triangle DEF, $m\angle E = 90$, $DE = 8$, $EF = 15$, and $FD = 17$. What is the value of tan F?

(1) $\frac{8}{17}$
(2) $\frac{15}{17}$
(3) $\frac{8}{15}$
(4) $\frac{15}{8}$

20 Which type of quadrilateral has diagonals that will always divide it into four congruent triangles?

(1) rhombus
(2) rectangle
(3) trapezoid
(4) isosceles trapezoid

21 Point $A'(12,4)$ is the image of point $A(3,1)$ under a dilation with respect to the origin. What is the constant of dilation?

(1) 9
(2) $\frac{1}{4}$
(3) 3
(4) 4

22 What is a solution for the system of equations $y = x^2 + 4$ and $y = x + 4$?

(1) (2,8)
(2) (0,4)
(3) (–1,3)
(4) (–2,8)

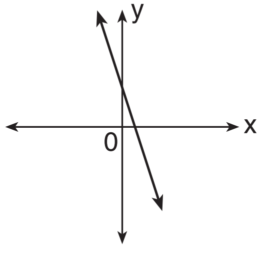
23 What is $\frac{x+3}{3x} + \frac{x-1}{5x}$, $x \uparrow 0$, expressed as a single fraction?

(1) $\frac{2x+2}{8x}$
(2) $\frac{8x+12}{15x^2}$
(3) $\frac{2x+2}{15x}$
(4) $\frac{8x+12}{15x}$

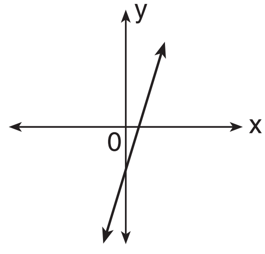
24 If the lengths of two sides of a triangle are 6 and 7, the length of the third side may be

(1) 1
(2) 12
(3) 13
(4) 14

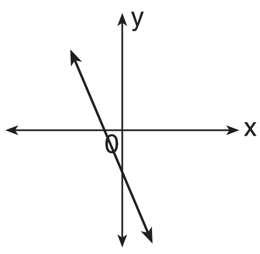
25 Which diagram represents the graph of the equation $y = 2x - 1$?



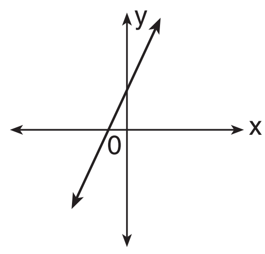
(1)



(3)



(2)



(4)

26 If the statements c, $c \rightarrow d$, and $p \rightarrow \sim d$ are true, which statement must also be true?

(1) p (3) $\sim d$
(2) $\sim p$ (4) $c \rightarrow p$

27 The graph of the equation $(x - 2)^2 + (y + 3)^2 = 36$ is a circle. What are the radius and the center of this circle?

(1) radius 36, center (–2,3)
(2) radius 36, center (2,–3)
(3) radius 6, center (–2,3)
(4) radius 6, center (2,–3)

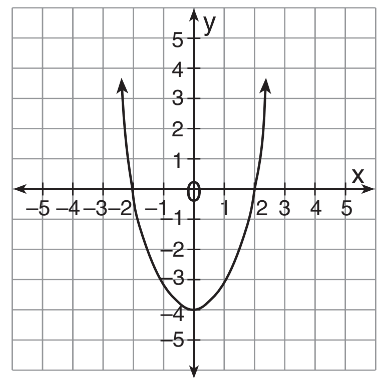
28 A base angle of an isosceles triangle measures 30°, and the length of one of the legs is 12. What is the length of the altitude drawn to the base of the triangle?

(1) $6\sqrt{3}$ (3) 6
(2) 12 (4) 9

29 Which equation represents a line that is perpendicular to the graph of the line $-2y = 4x + 10$?

(1) $y = \frac{1}{2}x + 6$ (3) $y = 2x + 6$
(2) $y = -\frac{1}{2}x + 6$ (4) $y = -2x + 6$

30 The accompanying diagram shows the graph of the parabola $y = ax^2 + bx + c$.



What must be one root of the equation $ax^2 + bx + c = 0$?

(1) –4 (3) 0
(2) –2 (4) 4

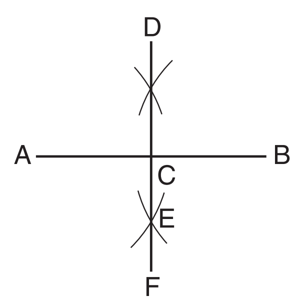
31 Which expression is the complete factorization of $32 - 18y^2$?

(1) $2(16 - 9y^2)$ (3) $2(3y + 4)(3y - 4)$
(2) $2(4 - 3y)^2$ (4) $2(4 - 3y)(4 + 3y)$

32 What is the turning point of the parabola whose equation is $y = -x^2 - 4x + 3$?

(1) (–2,–1) (3) (2,–9)
(2) (–2,7) (4) (2,–1)

33 Which construction is shown in the accompanying diagram?



(1) the bisector of $\angle ACD$
(2) the midpoint of $\overline{DF}$
(3) the perpendicular bisector of $\overline{AB}$
(4) a perpendicular line to $\overline{AB}$ from point D

34 The altitude drawn to the hypotenuse of a right triangle divides the hypotenuse into segments of lengths 4 and 12. The length of the shorter leg of the right triangle is

(1) 8
(2) $\sqrt{20}$
(3) $\sqrt{48}$
(4) $\sqrt{192}$

35 If each interior angle of a regular polygon measures 170°, what is the total number of sides in the polygon?

(1) 10
(2) 17
(3) 18
(4) 36

Answers to the following questions are to be written on paper provided by the school.

Part II

Answer three questions from this part. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Calculations that may be obtained by mental arithmetic or the calculator do not need to be shown. [30]

36 *a* Draw and label the graph of the equation $y = 2x^2 + 4x - 7$ for all values of x in the interval $-4 \le x \le 2$. [6]

b On the same set of axes, draw the image of the graph drawn in part *a* after a reflection in the y-axis and label it *b*. [2]

c What is the equation of the axis of symmetry of the graph drawn in part *b*? [2]

37 *a* In right triangle PQR, altitude $\overline{RS}$ is drawn to hypotenuse $\overline{PQ}$, $RS = 12$, and PS is 7 more than QS. Find QS. [6]

b Solve for x, $x \uparrow 0$ and $x \uparrow -1$:

$$\frac{4}{x} + \frac{2}{3x} = \frac{4}{x+1} \quad [4]$$

38 *a* For all values of k for which these expressions are defined, express the product in simplest form:

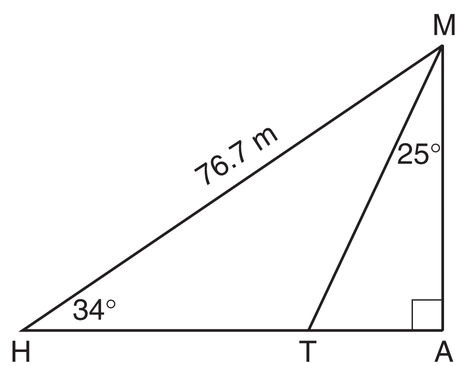
$$\frac{3k^3 - 27k}{k^2 + 4k + 3} \bullet \frac{k^2 + k}{6k^3} \quad [5]$$

b Christine plans to rent six videos for the weekend. She has narrowed her selection to four comedies, eight mysteries, and three musicals. What is the probability that she randomly selects two comedies, three mysteries, and one musical? [5]

39 Solve the following system of equations graphically or algebraically and check:

$$x^2 + y^2 = 25$$
$$x - y = 1 \quad [8,2]$$

40 In the accompanying diagram of $\triangle HMA$, $\overline{MT}$ is drawn, $m\angle A = 90$, $m\angle MHA = 34$, $m\angle AMT = 25$, and $HM = 76.7$ meters.



a Find, to the *nearest tenth of a meter*, the length of

(1) $\overline{MA}$ [2]

(2) $\overline{HA}$ [2]

b Using the results from part *a*, find the area of $\triangle HMT$ to the *nearest square meter*. [6]

Answers to the following questions are to be written on paper provided by the school.

Part III

Answer one question from this part. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Calculations that may be obtained by mental arithmetic or the calculator do not need to be shown. [10]

41 Given: If Alex does not score well on his final exams and Alex does not earn an academic scholarship, then he does not go to college.

If Alex does not study, then he does not score well on his final exams.

If Alex gets involved in too many extracurricular activities, then Alex does not study.

Alex gets involved in too many extracurricular activities.

Alex goes to college.

Let C represent: "Alex goes to college."
Let E represent: "Alex earns an academic scholarship."
Let F represent: "Alex scores well on his final exams."
Let S represent: "Alex studies."
Let X represent: "Alex gets involved in too many extracurricular activities."

Prove: Alex earns an academic scholarship. [10]

42 The vertices of quadrilateral $ABCD$ are $A(-1,1)$, $B(4,5)$, $C(9,1)$, and $D(4,-3)$. Using coordinate geometry, prove that

a $ABCD$ is a rhombus [5]
b $ABCD$ is *not* a square [5]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

SEQUENTIAL MATH – COURSE II

Tuesday, January 22, 2002 — 1:15 to 4:15 p.m., only

Part I Score	....
Part II Score	....
Part III Score	....
Total Score	....
Rater's Initials:	....

ANSWER SHEET

Student .... Sex: ☐ Male ☐ Female Grade ....

Teacher .... School ....

Your answers to Part I should be recorded on this answer sheet.

Part I

Answer 30 questions from this part.

1	11	21	31 ....
2	12	22	32 ....
3	13	23	33 ....
4	14	24	34 ....
5	15	25	35 ....
6	16	26	
7	17	27	
8	18	28	
9	19	29	
10	20	30	

Your answers for Part II and Part III should be placed on paper provided by the school.

The declaration below should be signed when you have completed the examination.

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination and that I have neither given nor received assistance in answering any of the questions during the examination.

____
Signature

Tear Here

Tear Here

Tear Here